



Technology Evaluation for Environmental Risk Mitigation Principal Center

Non-Chrome Primers for Aircraft Exteriors

JG-PP Project Number: J-95-OC-002

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Project Summary

Primers are commonly applied to surfaces such as aircraft exteriors to provide corrosion protection to aluminum and steel surfaces. These primers contain hexavalent chromium which is a hazardous material and recognized human carcinogen. The Occupational Safety and Health Administration's (OSHA) Permissible Exposure Limit (PEL) for chromium was $100 \mu\text{g}/\text{m}^3$, reported as hexavalent chromium. OSHA has since reduced the PEL for hexavalent chromium to $5 \mu\text{g}/\text{m}^3$, calculated as an 8-hour time-weighted average and could further reduce it as low as $0.5 \mu\text{g}/\text{m}^3$. Facilities have a deadline of December 31, 2008 to implement feasible engineering changes to reduce the hexavalent chromium levels to comply with the latest PEL.

This project's purpose was to identify and validate nonchromate primers for use on aircraft exterior surfaces thus reducing required control measure while still reducing worker exposure to hexavalent chromium. Laboratory testing of nine nonchromate primers was completed in 1997. Department of Defense (DoD) operational testing continued through 2001. It has been estimated that use of nonchromate primers on DoD aircraft will result in a cost avoidance of at least \$1 million, and up to \$32 million, over 20 years.

National Aeronautics and Space Administration (NASA) was involved in the JG-PP Nonchromate Primer project and benefited from the results. Although no NASA-specific tests were conducted during the JG-PP project, NASA substrates and general performance requirements were incorporated into the test program. As a result, Boeing-Palmdale (Space Shuttle Orbiter program) was able to accept the results of the JG-PP testing, thus avoiding the time and cost of retesting one potential alternative they were interested in (approximately \$750,000) and gaining access to over \$2 million in aerospace flight test performance data.

After the data evaluation, NASA performed approved pilot testing of the nonchrome primer on the flipper doors of the Columbia Orbiter prior to STS-93. The purpose of the flipper door/chrome testing program was to convince Space Shuttle design personnel that the alternative non-chrome primer will hold up to space environments, launch/re-entry and the harsh environmental conditions found in Florida. The doors were specifically selected because they are "drip points" and due to paint thinning effects, see more than average amounts of corrosion. Qualitative results concluded that the nonchromate primer was performing as well as the chromate based control. A more in-depth inspection of the primer was scheduled to occur after STS-107, but unfortunately that did not occur due to the loss of Columbia. The nonchromate primer is now being applied to some brackets in the Orbiter's Payload Bay and at least one drawing has been changed to specify the nonchromate primer. The Orbiter's Corrosion Control Review Board is also currently looking for other opportunities to apply this alternative.